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ABSTRACT

The information packet is designed to provide teachers of bilingual learning disabled (LD) students with mathematics resources and information on diagnostic testing in language other than English, mathematics curriculum materials in languages other than English, and guidelines for operating an individualized math lab program for LD students in fourth through ninth grade. Specific difficulties of bilingual LD students are described in an overview. Section I contains a sample criterion referenced test in English/Spanish with an accompanying individual profile sheet and a list of sources for assessment instruments in mathematics in languages other than English. Section II provides information on curriculum materials, while Section III addresses management and recordkeeping. A final section offers further resources for bilingual math labs. (SB)

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Content Area E/53

DESIGNING AN INDIVIDUALIZED MATH LAB PROGRAM FOR THE BILINGUAL LD STUDENT (GRADES 4-9)

Compiled By:

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February, 1981

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DESIGNING AN INDIVIDUALIZED MATH LAB PROGRAM FOR THE BILINGUAL LD STUDENT (GRADES 4-9)

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A. Language of Instruction: Research on the Consequences of Teaching Mathematics in a First or Second Language.

B. Math the Universal Language

C. Manipulatives: The Missing Link
Using Math Manipulatives

Types Available:

Invicca ® Math Balance

⊕ ⊖ ⊗ ⊘ .><=, metric measurement

Beansticks/Counting Sticks

⊕ ⊖ ⊗ ⊘, place value><=

Unifix Cubes/Colored Cubes/Beads/Counters

⊕ ⊖ ⊗ ⊘. prime/composite numbers, odd/even numbers.

Base Ten Blocks

Base ten and measurement activities (length, area, volume)

Abacus

⊕ ⊖ ⊗ ⊕, place value, square roots, cube roots

Chip Trading

⊕ ⊖ ⊗ ⊕, place value, other bases

Cuisenaire® Rods

⊕ ⊖ ⊗ ⊕, fractions, problem solving, graphs

Fraction Bars

Recognition, equality/inequality, ⊕ ⊖ ⊗ ⊕ of fractions

Pattern Blocks/Tangrams

Figure recognition, problem solving, perimeter, area

Geoboards

Figure recognition, perimeter, area, congruence, coordinates

Source: Creative Publications
P.O. Box 10328
Palo Alto, California 94303
(415) 968-3977

Many of these manipulatives are accompanied by activity cards or student workbooks. One such set is called Picturing Arithmetic--From Models to Symbols. It is an excellent transition from experience to worksheets.

Creative Publications is also an excellent source for ready made activity cards and games as well as components for making your own games or activity cards.

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D. Textbooks, Workbooks, Curriculum Guides, Kits, Record/Tape Programs

--Culturally Relevant/Controlled English Materials (annotated)
--Spanish/English Materials
--Chinese/English Materials
Japanese/English Materials
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Pilipino/English Materials
--Vietnamese/English Materials
Lao/English Materials
Thai/English Materials
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INTRODUCTION

Very little assistance is available to teachers of monolingual learning disabled students with difficulties in mathematics. The abundance of available research and instructional strategies formulated for this population in reading is in sharp contrast to the paucity of such support in mathematics. Some who touch upon this subject caution that their suggestions for intervention are not based on empirical research findings but rather on a diagnostic/prescriptive intervention philosophy. (Gearheart; Hammill & Bartel.[1]) A knowledge of the developmental process of skill acquisition and conceptual development in mathematics is used as the baseline upon which student achievement is measured and deficiencies are discovered. Hypothese for deviation from normally developing children range from neurophysical explanations to those of poor attitudes and anxiety. Others include: ineffective instruction, difficulties in symbolic thinking, reading difficulties, memory problems and perceptual disorders. While underlying causes are not fully understood the concrete behavior observed in learning disabled pupils experiencing difficulty in mathematics classes in well documented.

1
Bill R. Gearheart, Teaching the Learning Disabled, C.V. Mosby Co., St. Louis 1976. pp. 116-139
Donald D. Hammill & Nettie R. Bartel, Teaching Children With Learning and Behavioral Problems. 1978. Allyn and Bacon. pp. 99-146.

LD students exhibit problems in renaming (regrouping), in knowledge of basic facts required for computation (Lepores, 1974[2]), in use of defective algorithms (procedural errors or performing the wrong operation), and in giving random responses (guessing), (Roberts, 1962[3]). Both Gearhart and Hammill & Bartel suggest a diagnostic approach that includes 1) an oral interview to document the child's mental process as she/he performs the operation and 2) an error analysis which gives tentative explanations for the students behavior. From this diagnosis an initial intervention plan is formulated. The best presentation method would not only account for the observed Piagetian stage of development but also account for the apparent learning style, preferred modalities and motivators. This is true for any learning disabled student with difficulties in mathematics. There are however, additional special needs that need to be taken into account when working with a bilingual learning disabled student in math. The intervention plan must also account for the most appropriate language of instruction and have relevance to the child's particular cultural and educational background.

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2 Lepore, A. A Comparison of Computational Errors Between Educable Mentally Handicapped and Learning Disability Children, Unpublished Manuscript, University of Connecticut, Storrs, Conn, 1974.

3 Roberts, G.H. The Failure Strategies of Third Grade Arithmetic Pupils, Arithmetic Teacher, 1962. pp. 15, 442-446.

This packet of information is an attempt to provide teachers of bilingual learning disabled students with resources and background information to better meet the needs of this special population. It includes information on diagnostic testing in languages other than English, curriculum materials in languages other than English, and other procedural information for program operation. It is intended as a working notebook where teachers can add information from other sources to build a personal resource guide. Specific difficulties of bilingual learning disabled pupils are described in the overview. A chart defining the stages in program implementation is also presented in that introductory section.

Following are the available resources to assist in implementing an individualized math lab program for the bilingual LD student. These resources are listed in the index for quick reference. It is hoped they will assist teachers in providing appropriate intervention for this special population.

OVERVIEW

OVERVIEW

SPECIFIC DIFFICULTIES OF BILINGUAL LEARNING DISABLED STUDENTS IN MATHEMATICS

The following are some of the problems exhibited by bilingual learning disabled students:[1]

1) Each item learned seems unconnected to previous learning; students seem unable to see relationships between processes.

2) Students, while able to complete a process, are unable to provide an explanation. They memorize without any understanding. This may be particularly true of students who learn in a weak second language (L_2) without the accompanying use of concrete materials. They may be able to model the teacher's behavior to complete a process but there may be no underlying understanding of the meaning of the process. This could also be true of teaching in the native language (L_1) where initial instruction is not connected to any concrete experience.

3) Students exhibit visual and auditory reversals. Students see 6 as 9, 5 as 2, 3 as 8 and viceversa. In the case where students write 4 for 1 and 4 for 7 there may be some confusion with the symbols 1 and 7. Students hear 14 as 40, 13, as 30, etc. Reversals may be particularly difficult to diagnose in bilingual populations due to that fact that visual or auditory confusion may arise for normal learners of particular backgrounds. Arabic symbol knowledge may lead students to confuse the meaning of the symbols 0, 3 and •. Vietnamese may be tempted to write 31 for 13 because they are used to writing the digits in the order spoken. This would be true of normal learners and would not define the reversal problem characteristic of some LD students. (See the article Math, The Universal Language? for a fuller explanation of this problem.)

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[1] This is a compilation of the particular difficulties I noted when teaching mathematics in a bilingual program in San Francisco to pupils aged 11-16 during the years 1974-1979. This is an anecdotal summary of my experience and is not meant to be taken as a comprehensive study on the subject.

4) Students have problems in setting up problems and in working problems. They lose their place, forget to do parts of the problem, repeat operations, make errors in recording their answers, confuse processes (use the wrong operation), write illegible digits or have problems keeping numbers in line. This may also be difficult to describe as a learning disability in a bilingual population for many of the paradigms and processes commonly followed in the United States differ widely from those taught in other countries. Students may be experiencing the normal confusion that results from such changes and we should examine their prior knowledge. (This problem is also described in the article Math the Universal Language? included in this packet.)

5) Since language is closely linked to cognitive development, we must be careful not to confuse linguistic performance with conceptual competence. There are bilingual students for whom a given concept will be more closely tied to the language in which the concept was acquired be it the native language (L_1) or the second language (L_2). In assessing that child's abilities in math we would want to use both languages. In this way we would assure the most accurate measure of his/her knowledge which was gained in two linguistic environments. There will be those students who have inadequate language capabilities (perhaps in both languages) to express the concepts they possess. These students may not be learning disabled. There may be no processing problem to remediate. Rather the most appropriate program might be a language enrichment program to help them develop the language they need to fully discuss or explain math concepts they possess. In the screening of bilingual students for possible learning disabilities we must fully explore the language performance issue to accurately respond to their needs. Therefore, it would be important to include non-verbal as well as verbal measures to look at cognitive processing skills.

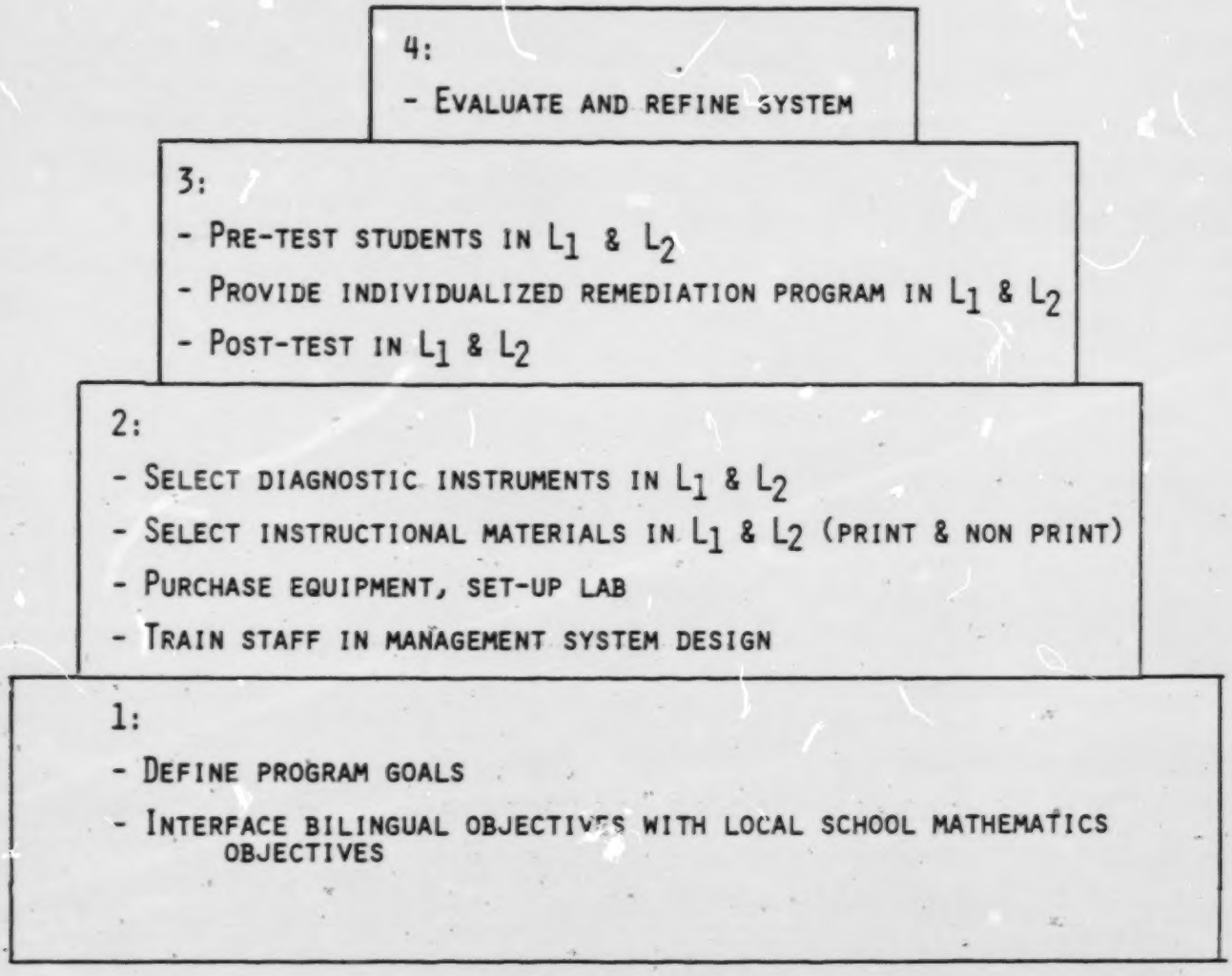
6) Some students have organizational problems. They can't follow complex instructions. They can't organize tasks to complete a process. They don't know how to start. They don't know what to do next.

7) Some students have a short attention span; can't stay on task; are hyperactive; easily distracted.

8) Some students have a weak short term memory. Every time they need facts to complete a computation they must relearn, recalculate.

9) Some students are frustrated by a history of failures; feel defeated; need encouragement to keep trying. Some students are extremely anxious about math; show avoidance behavior. In bilingual students this frustration might also occur by not being able to understand the language instruction for a period of time that causes them lag behind their peers. They may lose interest; feel excluded; feel unable to meaningfull participate and compete with their peers.

Stages in Implementing a Bilingual Math Lab Program


4:
- Evaluate and refine system
3:
- Pre-test students in L_1 & L_2
- Provide individualized remediation program in L_1 & L_2
- Post-test in L_1 & L_2
2:
- Select diagnostic instruments in L_1 & L_2
- Select instructional materials in L_1 & L_2 (print & non print)
- Purchase equipment, set-up lab
- Train staff in management system design
1:
- Define program goals
- Interface bilingual objectives with local school mathematics objectives

SECTION I: DIAGNOSTIC TESTING

SAN FRANCISCO UNIFIED SCHOOL DISTRICT

MATHEMATICS PROFILE SHEET

Student _____

School Year _____

Teacher _____

Key: [x] = mastery demonstrated on pre-test
[1/4] = date of mastery during term
(□) = circle in red - mastery post-test

NUMERATION - Place value

N-1. To 99: count, read, write, order
2. Place value, 2 place numerals
3. To 999: count by 1's, 10's, read, write, order
4. Place value, 3 place numerals
5. To 9,999; count, read, write, order
6. Place value, 4 place numerals
7. To 999,999: read, write, order
8. Place value, 5-6 place numerals
9. Recognize place value of 7 or more digits
10. Recognize odd and even numbers
11. Placement of commas between appropriate numerals.

ADDITION OF WHOLE NUMBERS

A-1. Basic addition facts
2. 2 to 4 place numbers, no regrouping
3. 2 to 4 place numbers with regrouping
4. Addition with zero (additive identity)
5. Column addition with regrouping

SUBTRACTION OF WHOLE NUMBERS

S-1 Basic subtraction facts
2. 2 to 4 place numbers, no regrouping
3. 2 to 4 place numbers (without zero) with regrouping
4. 2 to 4 place numbers with zero, regrouping
5. Prove subtraction

MULTIPLICATION OF WHOLE NUMBERS

M-1. Basic multiplication facts
2. 1 digit multiplication without regrouping
3. 1 digit multiplication with regrouping
4. 2 digit multiplier without regrouping
5. 2 digit multiplier with regrouping
6. 3 digit multiplier with and without regrouping
7. Understand multiplication by "one" (multiplication identity)
8. Use of zero in multiplication
9. Prove multiplication

SFUSD Mathematics Profile Sheet (Continued)

DIVISION OF WHOLE NUMBERS

D-1. Basic division facts ☐
2. 1 digit divisor, no regrouping, no remainder ☐
3. 1 digit divisor, with regrouping, with/without remainder ☐
4. 1 digit divisor, zero in quotient, with or without remainder ☐
5. 2 digit divisor, quotient one digit, with or without remainders ☐
6. 2 digit divisor, quotient 2 digits, with or without remainders ☐
7. 2 digit divisor, zero in quotient, with or without remainders ☐
8. 3 or more digit divisors ☐
9. Prove division ☐

INTRODUCTION TO FRACTIONS

IF-1. Recognize fractional parts, any denomination ☐
2. Equivalent fractions ☐
IF-3. Rename fraction to lowest terms ☐
4. Rename whole or mixed numbers as fractional numbers ☐
5. Rename fractional numbers as whole or mixed numbers ☐

ADDITION AND SUBTRACTION OF FRACTIONS

ASF-1. Addition and subtraction like fractions ☐
2. Addition and subtraction mixed numbers, like denominator (no borrowing in sub.) ☐
3. Subtraction mixed numbers, like denominator with borrowing ☐
4. Addition and subtraction unlike fractions ☐
5. Addition and subtraction mixed numbers unlike denominators (no borrowing in sub.) ☐
6. Subtraction mixed numbers, unlike denominator with borrowing ☐

MULTIPLICATION AND DIVISION OF FRACTIONS

MDF-1. Multiply a fraction x fraction ☐
2. Multiply a fraction x a whole number ☐
3. Multiply mixed numbers ☐
4. Understand reciprocals ☐
5. Divide a fraction by a fraction ☐
6. Divide a fraction by a whole number ☐
7. Divide a fraction by a mixed number ☐

SFUSD Mathematics Profile Sheet (Continued)

DECIMALS AND PERCENTS

DPC-1.	Read and write decimals to .999	☐
2.	Rename fraction numbers in 10ths, 100ths, 1000ths, to decimals and reverse	☐
3.	Add and subtract decimal numbers arranged vertically	☐
4.	Add and subtract decimal numbers arranged horizontally	☐
5.	Multiply a whole number by a decimal	☐
6.	Multiply a decimal by a decimal	☐
7.	Division of decimal by a whole number	☐
8.	Division of decimal by a decimal	☐
9.	Division of whole number by a decimal	☐
10.	Rounding decimals	☐
11.	Change decimal to percent	☐
12.	Change percent to decimal	☐
13.	Percent as a fraction	☐
14.	Number when percent is unknown	☐
15.	What percent one number is of another	☐

NUMBER THEORY

NT-1.	Common multiples	☐
2.	Factors	☐
3.	Common factors	☐
4.	Prime numbers	☐
5.	Composite numbers	☐
6.	Prime factorization	☐
7.	Greatest common factor	☐
8.	Least common multiple	☐

MEASUREMENT

M-1.	Ruler-measure to the nearest inch	☐
2.	Ruler - measure to the nearest ½ inch	☐
3.	Ruler - measure to the nearest 1/4 inch	☐
4.	Metric - measure to the nearest centimeter	☐

LEARNING CENTER CRITERION REFERENCED MATHEMATICS TEST

Name _____ Date _____

1. 327 +52 a) 368 b) 369 c) 378 d) 379 e) none (A-1,2)	5. 116 + 36 + 7 = a) 159 b) 483 c) 852 d) 1,176 e) none (A-5)
2. 1,254 + 948 a) 1,192 b) 2,102 c) 2,202 d) 111,912 e) none (A-3)	6. 348 -12 a) 326 b) 335 c) 336 d) 356 e) none (S-1,2)
3. 346 1,594 + 781 a) 1,511 b) 2,621 c) 2,720 d) 2,721 e) none (A-3)	7. 37 -18 a) 19 b) 21 c) 29 d) 55 e) none (S-3)
4. 307 +28 a) 315 b) 335 c) 3,015 d) 3,215 e) none (A-3,4)	8. 9,643 - 875 a) 232 b) 8,768 c) 8,878 d) 9,232 (S-3)

9. 620 -443 a) 223 b) 220 c) 183 d) 177 e) none (S-4)	13. 34 X12 a) 38 b) 102 c) 406 d) 408 e) none (M-4)
10. 1,500 - 304 a) 1,196 b) 1,106 c) 1,204 d) 1,200 e) none (S-4)	14. 48 X63 a) 3,024 b) 432 c) 264 d) 144 e) none (M-5)
11. 432 X 2 a) 434 b) 465 c) 654 d) 864 e) none (M-2)	15. 385 X 761 a) 2,585 b) 5,381 c) 50,435 d) 292,985 e) none (M-6)
12. 875 X 6 a) 5,220 b) 5,250 c) 8,730 d) 484,230 e) none (M-3)	16. 465 x 1 = a) 465 b) 466 c) 4,650 d) 4,660 e) none (M-7)

17. $\begin{array}{r} 20 \\ \times\ 7 \\ \hline \end{array}$

a) 147
b) 140
c) 97
d) 90
e) none

(M-8)

18. $3\overline{)36}$

a) 13
b) 12
c) 11
d) 10
e) none

(D-2)

19. $4\overline{)98}$

a) 2 R 18
b) 22
c) 24
d) 24 R 2
e) none

(D-3)

20. $3\overline{)621}$

a) 2 R 7
b) 207
c) 200
d) 27
e) none

(D-4)

21. $38\overline{)77}$

a) 20 R 1
b) 20
c) 2 R 1
d) 2
e) none

(D-5)

22. $61\overline{)1,464}$

a) 24
b) 204
c) 240
d) 2,400
e) none

(D-6)

23. $23\overline{)924}$

a) 4 R 4
b) 40 R 4
c) 44
d) 400 R 4
e) none

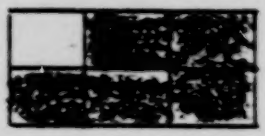
(D-7)

24. $435\overline{)693}$

a) 1
b) 1 R 262
c) 1 R 258
d) 100 R 258
e) none

(D-8)

25. Name the fractional parts shaded.



a) $\frac{1}{6}$
b) $\frac{5}{6}$
c) 5
d) 6
e) none

(IF-1)

26. Raise to higher terms:

$\frac{3}{4} =$

a) $\frac{6}{8}$
b) $\frac{8}{12}$
c) $\frac{6}{15}$
d) $1\frac{1}{4}$
e) none

(IF-2)

27. Reduce to lowest terms:

$\frac{2}{4} =$

a) $\frac{1}{4}$
b) $\frac{2}{4}$
c) $\frac{1}{2}$
d) $\frac{4}{8}$
d) none

(IF-3)

28. Change to an improper fraction:

$2\frac{2}{3} =$

a) $\frac{4}{3}$
b) $\frac{8}{3}$
c) $\frac{4}{5}$
d) $\frac{2}{6}$
e) none

(IF-4)

29. Change to a mixed number.

$\frac{6}{5} =$

a) $\frac{11}{5}$
b) $1\frac{1}{6}$
c) $1\frac{1}{5}$
d) 1
e) none

(IF-5)

30. Reduce all answers to lowest terms

$$\begin{array}{r} \frac{1}{3} \\ +\ \frac{1}{3} \\ \hline \end{array}$$

a) 1
b) $\frac{2}{6}$
c) $\frac{1}{3}$
d) $\frac{2}{3}$
e) none

(ASF-1)

31.

$$\begin{array}{r} \frac{7}{12} \\ -\ \frac{2}{12} \\ \hline \end{array}$$

a) $\frac{5}{0}$
b) $\frac{5}{5}$
c) $\frac{5}{12}$
d) $\frac{9}{24}$
d) none

(ASF-1)

32.

$$\begin{array}{r} 5\ \frac{1}{4} \\ +\ 2\ \frac{3}{4} \\ \hline \end{array}$$

a) 8
b) $7\frac{4}{4}$
c) $7\frac{4}{8}$
d) 11
d) none

(ASF-2)

33. $15\frac{1}{2} - 7$

a) 8
b) $8\frac{1}{2}$
c) 9
d) $9\frac{1}{2}$
e) none

(ASP-2)

34. $7 - 2\frac{3}{5}$

a) $4\frac{2}{5}$
b) 5
c) $5\frac{2}{5}$
d) $5\frac{3}{5}$
e) none

(ASP-3)

35. $\frac{1}{2} + \frac{1}{3}$

a) $\frac{1}{5}$
b) $\frac{2}{5}$
c) $\frac{2}{6}$
d) $\frac{5}{6}$
d) none

(ASP-4)

36. $2\frac{1}{4} + 1\frac{2}{3}$

a) $3\frac{3}{4}$
b) $3\frac{3}{7}$
c) $3\frac{7}{12}$
d) $3\frac{11}{12}$
e) none

(ASP-5)

37. $6\frac{3}{8} - 4\frac{3}{4}$

a) $2\frac{0}{4}$
b) $2\frac{3}{8}$
c) $1\frac{5}{8}$
d) $1\frac{7}{8}$
e) none

(ASP-6)

38. $\frac{1}{3} \times \frac{4}{5}$

a) $\frac{4}{15}$
b) $\frac{5}{15}$
c) $\frac{4}{8}$
d) $\frac{5}{8}$
d) none

(MDF-1)

39. $\frac{3}{7} \times 2$

a) 6
b) $\frac{6}{7}$
c) $\frac{6}{9}$
d) $\frac{6}{14}$
d) none

(MDF-2)

40. $3\frac{1}{2} \times 1\frac{1}{4}$

a) $3\frac{1}{8}$
b) $3\frac{2}{8}$
c) $4\frac{1}{8}$
d) $4\frac{3}{8}$
e) none

(MDF-3)

41. The reciprocal of $\frac{3}{4}$ is

a) 3
b) 4
c) $\frac{3}{4}$
d) $\frac{4}{3}$
e) none

(MDP-4)

42. $\frac{1}{7} \div \frac{3}{4} =$

a) $\frac{3}{28}$
b) $\frac{4}{21}$
c) $\frac{3}{11}$
d) $\frac{3}{10}$
e) none

(MDP-5)

43. $\frac{4}{5} \div 3$

a) $\frac{7}{8}$
b) $\frac{5}{12}$
c) $\frac{4}{15}$
d) $\frac{12}{15}$
e) none

(MDP-6)

44. $1\frac{1}{4} \div 2\frac{2}{3}$

a) 2
b) $3\frac{3}{7}$
c) $\frac{40}{12}$
d) $\frac{15}{32}$
e) none

(MDP-7)

45. .7 is read as 7 _____

a) ones
b) tens
c) tenths
d) hundredths
e) none

(DPC-1)

46. .75 is read as 75_____

a) ones
b) tens
c) tenths
d) hundredths
e) none

(DPC-1)

47. .075 is read as 75 _____

a) ones
b) tenths
c) hundredths
d) thousandths
e) none

(DPC-1)

48.

$$\begin{array}{r} 1.7 \\ +\ 5.85 \\ \hline \end{array}$$

a) 7.5
b) 7.55
c) 6.15
d) 6.155
e) none

(DPC-3)

49. 14.1 − 3.19

a) 10.91
b) 11.00
c) 11.01
d) 11.09
e) none

(DPC-3)

50. 4.8 + .86 + .093

a) 2.27
b) .227
c) 5.753
d) 5.1753
e) none

(DPC-4)

51. 36.5 − 8.78

a) 5.13
b) 27.72
c) 27.88
d) 32.28
e) none

(DPC-4)

52. 12 × .4

a) .46
b) 4.6
c) .48
d) 4.8
e) none

(DPC-5)

53. 2.62 × .85

a) 3.50
b) 20.90
c) 2.2270
d) 222.70
e) none

(DPC-6)

54. $3\overline{)7.35}$

a) 245
b) .245
c) 2.45
d) 24.5
e) none

(DPC-7)

55. $.4\overline{)24.12}$

a) .63
b) 6.3
c) 6.03
d) 60.3
e) none

(DPC-8)

56. $.25\overline{)175}$

a) .7
b) 7
c) 70
d) 700
e) none

(DPC-9)

57. Round off to the nearest hudredths place:

.6473

a) .60
b) .64
c) .65
d) .647
e) none

(DPC-10)

58. Change to a percent:

.48 =

a) 48
b) 48%
c) .48%
d) 4.8%
e) none

(DPC-11)

59. Change to a decimal:

75% =

a) 75.
b) 7.5
c) .75
d) 7.50
e) none

(DPC-12)

60. Write as a fraction:

25% =

a) $\frac{25}{1}$
b) $\frac{25}{10}$
c) $\frac{25}{100}$
d) $\frac{1}{2}$
e) none

(DPC-13)

61. What is 25% of 60?

a) 15
b) 30
c) 45
d) 60
e) none

(DPC-14)

62. 5 is what % of 25?

a) 5%
b) 20%
c) 25%
d) 50%
e) none

(DPC-15)

CENTRO BILINGÜE
EXÁMEN DE MATEMÁTICAS

NÚMEROS ENTEROS

Nombre_____ Fecha_____

1. 327 +52	a) 368 b) 369 c) 378 d) 379 e) ninguna	5. 116 + 36 + 7 =	a) 159 b) 483 c) 852 d) 1,176 e) ninguna
2. 1,254 + 948	a) 1,192 b) 2,102 c) 2,202 d) 111,912 e) ninguna	6. 348 -12	a) 326 b) 335 c) 336 d) 356 e) ninguna
3. 346 1,594 + 781	a) 1,511 b) 2,621 c) 2,720 d) 2,721 e) ninguna	7. 37 -18	a) 19 b) 21 c) 29 d) 55 e) ninguna
4. 307 +28	a) 315 b) 335 c) 3,015 d) 3,215 e) ninguna	8. 9,643 - 875	a) 232 b) 8,768 c) 8,878 d) 9,232 e) ninguna

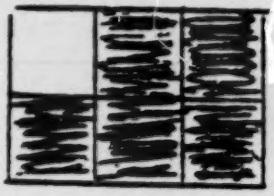
Examen de Matemáticas Página 2

9. 620 -443 a) 223 b) 220 c) 183 d) 177 e) ninguna	13. 34 x12 a) 38 b) 102 c) 406 d) 408 e) ninguna
10. 1,500 - 304 a) 1,196 b) 1,106 c) 1,204 d) 1,200 e) ninguna	14. 48 x63 a) 3,024 b) 432 c) 264 d) 144 e) ninguna
11. 432 x 2 a) 434 b) 465 c) 654 d) 864 e) ninguna	15. 385 x761 a) 2,585 b) 5,381 c) 50,435 d) 292,985 e) ninguna
12. 875 x 6 a) 5,220 b) 5,250 c) 8,730 d) 484,230 e) ninguna	16. 465 x 1 = a) 465 b) 466 c) 4,650 d) 4,660 e) ninguna

Exámen de Matemáticas Página 3

17. 20 × 7 a) 147 b) 140 c) 97 d) 90 e) ninguna	21. 77 ÷ 38 = a) 20 r. 1 b) 20 c) 2 r. 1 d) 2 e) ninguna
18. 36 ÷ 3 = a) 13 b) 12 c) 11 d) 10 e) ninguna	22. 1464 ÷ 61 = a) 24 b) 204 c) 240 d) 2400 e) ninguna
19. 98 ÷ 4 = a) 2 r. 18 b) 22 c) 24 d) 24 r. 2 e) ninguna	23. 924 ÷ 23 = a) 4 r. 4 b) 40 r. 4 c) 44 d) 400 r. 4 e) ninguna
20. 621 ÷ 3 = a) 2 r. 7 b) 207 c) 200 d) 27 e) ninguna	24. 693 ÷ 435 = a) 1 b) 1 r. 262 c) 1 r. 258 d) 100 r. 258 e) ninguna

25. Nombre la parte fraccionaria coloreada.



a) $\frac{1}{6}$
b) $\frac{5}{6}$
c) 5
d) 6
e) ninguna

26. Convierta a términos mayores.

$\frac{3}{4} =$

a) $\frac{6}{8}$
b) $\frac{8}{12}$
c) $\frac{6}{15}$
d) $1\frac{1}{4}$
e) ninguna

27. Reduzca a términos mínimos.

$\frac{2}{4} =$

a) $\frac{1}{4}$
b) $\frac{2}{4}$
c) $\frac{1}{2}$
d) $\frac{4}{8}$
e) ninguna

28. Cambie a una fracción impropia.

$2\frac{2}{3} =$

a) $\frac{4}{3}$
b) $\frac{8}{3}$
c) $\frac{4}{5}$
d) $\frac{2}{6}$
e) ninguna

29. Cambie a un número mixto.

$\frac{6}{5} =$

a) $\frac{11}{5}$
b) $1\frac{1}{6}$
c) $1\frac{1}{5}$
d) 1
e) ninguna

Reduzca todas las respuestas a términos mínimos.

30. $\frac{1}{3} + \frac{1}{3}$

a) 1
b) $\frac{2}{6}$
c) $\frac{1}{3}$
d) $\frac{2}{3}$
e) ninguna

31. $\frac{7}{12} - \frac{2}{12}$

a) $\frac{5}{0}$
b) $\frac{5}{5}$
c) $\frac{5}{12}$
d) $\frac{9}{24}$
e) ninguna

32. $5\frac{1}{4} + 2\frac{3}{4}$

a) 8
b) $7\frac{4}{4}$
c) $7\frac{4}{8}$
d) 11
e) ninguna

33. $15\frac{1}{2} - 7$

a) 8
b) $8\frac{1}{2}$
c) 9
d) $9\frac{1}{2}$
e) ninguna

34. $7 - 2\frac{3}{5}$

a) $4\frac{2}{5}$
b) 5
c) $5\frac{2}{5}$
d) $5\frac{3}{5}$
e) ninguna

35. $\frac{1}{2} + \frac{1}{3}$

a) $\frac{1}{5}$
b) $\frac{2}{5}$
c) $\frac{2}{6}$
d) $\frac{5}{6}$
e) ninguna

36. $2\frac{1}{4} + 1\frac{2}{3}$

a) $3\frac{3}{4}$
b) $3\frac{3}{7}$
c) $3\frac{7}{12}$
d) $3\frac{11}{12}$
e) ninguna

37. $6\frac{3}{8} - 4\frac{3}{4}$

a) $2\frac{0}{4}$
b) $2\frac{3}{8}$
c) $1\frac{5}{8}$
d) $1\frac{7}{8}$
e) ninguna

38. $\frac{1}{3} \times \frac{4}{5} =$

a) $\frac{4}{15}$
b) $\frac{5}{15}$
c) $\frac{4}{8}$
d) $\frac{5}{8}$
e) ninguna

39. $\frac{3}{7} \times 2 =$

a) 6
b) $\frac{6}{7}$
c) $\frac{6}{9}$
d) $\frac{6}{14}$
e) ninguna

40. $3\frac{1}{2} \times 1\frac{1}{4} =$

a) $3\frac{1}{8}$
b) $3\frac{2}{8}$
c) $4\frac{1}{8}$
d) $4\frac{3}{8}$
e) ninguna

41. El recíproco de $\frac{3}{4}$ es:

a) 3
b) 4
c) $\frac{3}{4}$
d) $\frac{4}{3}$
e) ninguna

42. $\frac{1}{7} \div \frac{3}{4} =$

a) $\frac{3}{28}$
b) $\frac{4}{21}$
c) $\frac{3}{11}$
d) $\frac{3}{10}$
e) ninguna

43. $\frac{4}{5} \div 3 =$

a) $\frac{7}{8}$
b) $\frac{5}{12}$
c) $\frac{4}{15}$
d) $\frac{12}{15}$
e) ninguna

44. $1\frac{1}{4} \div 2\frac{2}{3} =$

a) 2
b) $3\frac{3}{7}$
c) $\frac{40}{12}$
d) $\frac{15}{32}$
e) ninguna

45. Se lee .7 como 7 _____.

a) unidades
b) decenas
c) décimas
d) centésimas
e) ninguna

46. .75 se lee como 75 _____.

a) unidades
b) decenas
c) décimas
d) centésimas
e) ninguna

47. .075 se lee como 75 _____.

a) unidades
b) decenas
c) centésimas
d) milésimas
e) ninguna

DECIMALES

48. $\begin{array}{r} 1.7 \\ +\ 5.85 \\ \hline \end{array}$

a) 7.5
b) 7.55
c) 6.15
d) 6.155
e) ninguna

49. 14.1 -3.19 a) 10.91 b) 11.00 c) 11.01 d) 11.09 e) ninguna	53. 2.62 x .85 a) 3.50 b) 20.90 c) 2.2270 d) 222.70 e) ninguna
50. 4.8 + .86 + .093 = a) 2.27 b) .227 c) 5.753 d) 5.1753 e) ninguna	54. 7.35 ÷ 3 = a) 245 b) .245 c) 2.45 d) 24.5 e) ninguna
51. 36.5 - 8.78 = a) 5.13 b) 27.72 c) 27.88 d) 32.28 e) ninguna	55. 24.12 ÷ .4 = a) .63 b) 6.3 c) 6.03 d) 60.3 e) ninguna
52. 12 x .4 a) .46 b) 4.6 c) .48 d) 4.8 e) ninguna	56. 175 ÷ .25 = a) .7 b) 7 c) 70 d) 700 e) ninguna

57. Redondee al centésima más cercana:

.6473=

a) .60
b) .64
c) .65
d) .647
e) ninguna

58. Convierta a un porciento:

.48 =

a) 48
b) 48%
c) .48%
d) 4.8%
e) ninguna

59. Convierta a un decimal:

75% =

a) 75.
b) 7.5
c) .75
d) 7.50
e) ninguna

60. Escriba como una fracción:

25% =

a) $\frac{25}{1}$
b) $\frac{25}{10}$
c) $\frac{25}{100}$
d) $\frac{1}{2}$
e) ninguna

61. ¿Cuál es 25% de 60?

a) 15
b) 30
c) 45
d) 60
e) ninguna

62. Halle qué porciento 5 es de 25:

a) 5%
b) 20%
c) 25%
d) 50%
e) ninguna

21

Math testing: Sources for tests in languages other than English

by Dennis Terdy

When the question arises of testing limited-English-proficiency students for ability, achievement, or placement in math, many teachers and administrators are forced to turn to the math instruments in English because they are readily at hand. However, additional resources in the first language of the student are available to the math curriculum specialist, teacher, or administrator. These tests may more suitably fit the testing purpose of the school and needs of the student. Three general sources which may be helpful to locate such test materials are publications about testing, large local educational agencies, and resource centers from the ESEA Title VII network.

Publications (predominantly norm-referenced and commercially prepared)

A recent publication by Santillana Publishing Co. of New York is entitled *A Guide to Assessment Instruments for Limited English Speaking Students.* This publication lists tests available, the language in which they are available, and an annotation concerning each. Many tests in this publication are in languages other than Spanish, though a majority of these are at the elementary grade level. Another publication which annotates tests in eight languages, is from the Dissemination and Assessment Center for Bilingual Education (DACBE) in Austin, TX. It is entitled *Evaluation Instruments for Bilingual Education: An Annotated Bibliography.*

Large local educational agencies (primarily criterion-referenced)

Although these tests are suited to the city's needs and goals, their content may also reflect those of a smaller district. They may even be *more* culturally sound and have *more* appropriate content than a standardized, norm-referenced test.

National network of Title VII ESEA centers

Located in over 32 cities, these centers list by language and content areas, the sources available to the populations and educational associations they serve. There are three types of centers: Resource Centers (like the Midwest Resource Center located at the Bilingual Education Service Center in Arlington Heights, IL), Materials Development Centers, and Dissemination and Assessment Centers. Each has a specific function in the National Network, yet all can help in identifying appropriate native language math assessment instruments.

If a locally developed math test is not satisfactory for placing limited-English-proficiency students or measuring achievement in math, there are sources available to locate such a test. Considering the many variables involved, such as culture, language, and grade level, it is wise to investigate all the resources available prior to selecting the instrument to be used, thus insuring a more sound and appropriate means of meeting student and program needs.

(Dennis Terdy is a bilingual consultant with the Illinois Resource Center and has been teaching in bilingual programs for seven years.)

SECTION II: CURRICULUM MATERIALS FOR A BILINGUAL MATH LAB

Math and the Bilingual Student

Mathematics and the bilingual child: research on the consequences of teaching mathematics in a first or second language

by Nancy Dew and Else Hamayan

In this article we shall review some of the research concerning mathematics and bilingual education in an attempt to clarify four issues: 1) what are the consequences of learning math in a non-dominant language? 2) what are the specific difficulties encountered in solving problems in a non-dominant language? 3) is there evidence for gains in achievement when math is taught in a child's dominant language? 4) what factors should be considered for choosing the language of instruction in math?

Consequences of learning math in a non-dominant language

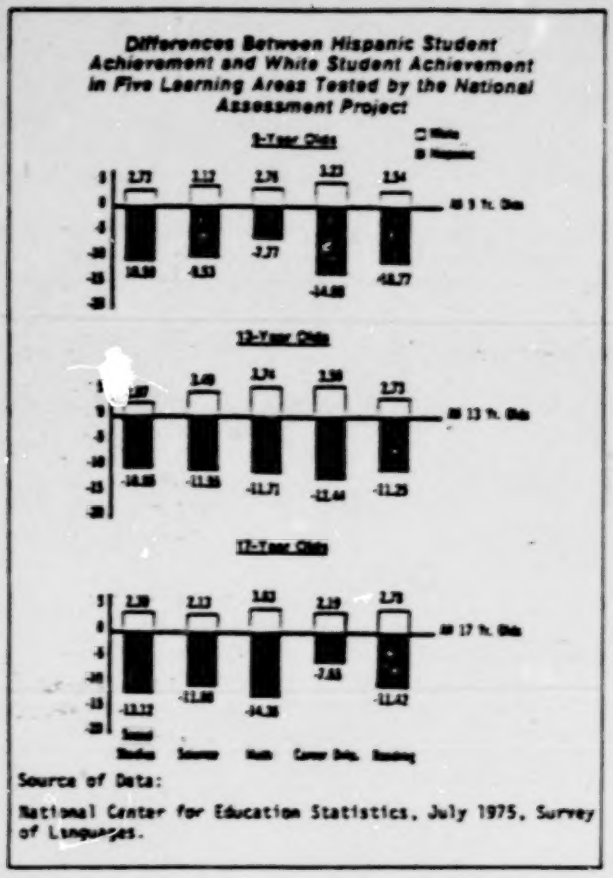
Lower achievement of limited or non-English speaking students in regular education programs in the U.S. is a well-documented finding (U.S. Commission on Civil Rights, 1975). One example of the disparity is shown by a 1975 national survey that clearly indicates a considerable gap between Hispanic student achievement and white student achievement in five learning areas. (See Figure 1). Of particular interest is the difference in performance in the area of math where the gap between Hispanic students and white students increases with age. One assumption is that Hispanics suffer a reduction in achievement because they approach the area of math in a non-dominant language. In a study by Macnamara (1966) the premise was supported that instruction in a weaker language led to difficulties in problem arithmetic. The subjects used in this study were both instructed and tested in their weaker language making it difficult to clearly determine whether the lower problem arithmetic scores were due to the teaching or testing situation or both of these phenomena (Cummins 1977 B). However, for our purposes it is a moot point as it clearly suggests that use of the non-dominant language in teaching and/or testing does, in fact, lower achievement scores in math. According to the Piagetian theory on the development of language and thought, formal operational thought essential for solving problems in arithmetic would be hindered without the necessary language development to support it. According to Cummins (1977), "the facility with which a bilingual child can utilize the symbolic system of each language to express and develop his thought is a relevant consideration in explaining his academic performance."*

Specific difficulties encountered in solving problems in a non-dominant language

There is evidence (MacNamara, 1970) that when solving problems in a non-dominant language, some basic difficulties in language interfere with and impede problem solving. Time is one of the factors causing difficulty in solving problems in a non-dominant language, and as a

* Cummins, J. "Psycholinguistic Evidence" *Bilingual Education: Current Perspectives. Education* Arlington, VA: Center for Applied Linguistics, p. 88, 1977.

(continued on next page)


Differences Between Hispanic Student Achievement and White Student Achievement in Five Learning Areas Tested by the National Assessment Project
9-Year Olds
13-Year Olds
17-Year Olds
Source of Data:
National Center for Education Statistics, July 1975, Survey of Languages.

result, a bigger load is placed on the short-term memory. In cases where problem-solving actually involves language, there is the additional difficulty of determining meanings of words, and relationships between words as determined by the syntax of the language. These findings, taken together, do indicate specific difficulties encountered by individuals when solving problems in their non-dominant language. They directly affect both academic achievement scores and the cognitive processes involved in problem-solving. They have also been the basis for approaches such as bilingual schooling which seek to improve the scholastic achievement of students of limited-English proficiency.

Gains in achievement when math is taught in the dominant language

A number of studies have compared limited or non-English-speaking students' achievement in bilingual programs. As far as math is concerned, there are data indicating that students of limited-English proficiency instructed in their dominant language in bilingual programs have higher achievement scores in math than their counterparts in regular programs. Some studies indicate that students instructed in bilingual programs actually exceed the national norms in mathematics achievement. In a longitudinal study conducted in Santa Fe, New Mexico in 1978, it was found that all bilingual groups studied outperformed the control or "regular" program group in mathematics achievement when tested on the Metropolitan Achievement Test in English. Both longitudinal (3-5 yrs. in the program) and non-longitudinal (enrolled only for a given year) bilingual groups were studied to determine how length of time in a bilingual program contributed to achievement. The most significant finding of the study was that the greatest longitudinal bilingual group (5 yrs. in program) was not only superior to the control group but also surpassed all other bilingual groups studied *and* the national averages in mathematics achievement. (National Dissemination and Assessment Center, 1978).

Similar results are reported by Rudolph Troike for the St. John Valley, MN, French bilingual program where the bilingually trained students (in a 5 year longitudinal program, 1970-75) were found to outperform students in the control group in mathematics achievement and were still surpassing the non-bilingual group at the date of Troike's publication. Troike also named five other studies where students in bilingual programs achieved at rates equal to or greater than students in non-bilingual programs in mathematics (Troike, 1978). In another review of research on bilingual education Zappert and Cruz report five studies where bilingual students tested in English on standardized achievement tests in mathematics performed at least equal to, but in most cases significantly better than, the all-English instruction group. (Zappert and Cruz, 1977). It is interesting to note that higher achievement scores are obtained by students in bilingual programs even when math is tested in English. This find is also supported by Cohen (1973), Flores (1969) and was the case in the 1978 Santa Fe Study. Thus, there is strong evidence for gains in achievement in math when it is taught via the student's dominant language, whether tested in that language or not.

Factors to consider when choosing the language of instruction in mathematics

A recent study of two Finnish researchers (Skutnabb-Kangas and Toukomaa, 1976) for the Finnish UNESCO Commission presents powerful evidence for looking at the child's stage of development to determine the language of instruction. They suggest that if children are submersed in instruction in another language before the age of ten (before the formal operations stage), the development of their native language as a tool for cognitive organization is affected. More importantly for those wishing to effectively utilize the second language as a means of instruction, children may fail to acquire the ability to use the second language for such purposes as well. The result is that students are not fully competent to carry out complex cognitive operations in either language (Troike, 1978, pp. 13-14). Where the students possessed language at the abstraction level in their mother tongue they were able to master the conceptual operations connected with mathematics, even when instructed in their second language. Where the mother tongue was not sufficiently developed to support abstract thought, students performed at a significantly lower rate. This study suggests that there is a threshold of native language competence necessary to avoid cognitive deficits. More to the issue at hand, first language skills are closely related to the level of achievement possible in mathematics. A study of Tagalog speakers in the Philippines, conducted by Ramos et al. in 1967 reaches similar conclusions about the relationship between mother tongue development and achievement in mathematics (Paulston, 1977).

The evidence for the importance of language development in relation to achievement in mathematics is striking.

Native language development clearly influences these areas: achievement level scores attained in math, the student's problem solving abilities in math, and the cognitive stage development (level of abstract thought) that can be attained.

[Nancy Cole is a consultant with the Illinois Resource Center and came to IRC recently from San Francisco where for six years she taught in Spanish bilingual programs. Also she has been a bilingual coordinator and a Title VII curriculum writer.

Bee Hamayan is a consultant with the Midwest Resource Center. She has done research on issues concerning second language acquisition and teaching, and speaks five languages.]

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Math the Universal Language?

by Minerva Coyne

Statements like "He has trouble with the English language but I'm sure he'll be all right at math" are common when dealing with students from other cultures and speakers of other languages. But it is becoming increasingly clear that this kind of assumption is very often false. The belief that math has a universal language and that this will facilitate its instruction to students of different cultural backgrounds is a myth. Possible problem areas are: 1) word/symbol recognition, 2) vocabulary, and 3) the ordering and processes followed in basic computation and problem solving.

Word/Symbol Recognition Problems

Even simple symbols such as a comma or decimal point can cause confusion for the teacher with French, Haitian, Italian and Spanish speaking students in her/his classroom. Their system uses a decimal point where the American uses a comma, and vice versa. (Example: 1.25 is written 1,25 and 1,000 is written 1.000. Numbers are sometimes written differently too, such as ٧ for 7, and ١ for 1. In Arabic the symbols for numbers are almost totally different. They read from left to right as follows:

Arabic: ١٠ ٩ ٨ ٧ ٦ ٥ ٤ ٣ ٢ ١ ٠

English: (10) (9) (8) (7) (6) (5) (4) (3) (2) (1) (0)

Students with an Arabic schooling background may confuse the English symbol for zero (0) for an Arabic "5". A period (.) in English may be taken for the Arabic symbol for zero. The (Arabic) ٤ which means four may be confused for an English *three* (3).

Vietnamese give numbers their names in the order the digits occur. Therefore for the numbers 13-19 in English there may be difficulties for the Vietnamese student in knowing which digit to write first. They may be tempted to write 31 when we say *thirteen* or 91 when we say *nineteen*.

Vietnamese and traditional Spanish schools teach 24 as 2 tens and 4 ones or 20 + 4. Students do not know the expanded notation step of (2 × 10) + (4 × 1) = 24, however, and need to become familiar with it to follow most math textbooks in the United States.

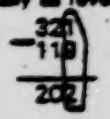
When naming fractions, Korean students will name the denominator first: half-one (1/2) as opposed to one half as is done in English. In the United States we name this angle ∠ABC, while Vietnamese will represent the angle: ∠B. In the United States we name each separate angle: ∠A, ∠B, ∠C. The Vietnamese name the same angles 2 1 3. Americans name this triangle, △ABC. Vietnamese name it △B. So the position of symbols may vary as well.

Vocabulary Problems

Chilren of limited-English-speaking abilities face several obstacles when they attempt to understand mathematical vocabulary. Many math words, such as accend, quadrilateral, and polygon are likely to be encountered only in math textbooks. Some words such as factor, set, table, base, ray, plane, and function, are met elsewhere in a child's world, in ESL lessons or in English readers, but their meanings are or could be quite different than when encountered in a mathematics context.

Ordering & Process Problems

The process followed in mathematical operations are often very different around the world. Haitian subtraction is sometimes done mentally as reverse addition:



The student works the problem like this: Rather than saying, "Eleven take away nine equals what?", the student will say, "Nine plus what equals eleven?". The answer is the same but the process going on is quite different. This procedure known as the "additive approach", is sometimes used by people in the United States, but is less common than the "take-away" approach.

Vietnamese students, Haitian students, and students from Spain and parts of Latin America follow a different process both in thought and in writing than Americans when doing division. The following example illustrates the Vietnamese form used to divide 3,330 by 74.

3330	74
370	45
9	

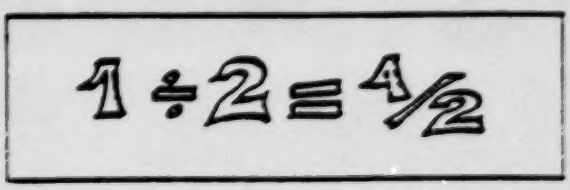
Hispanics show the process in a similar form.

3330	74
−296	45
370	
−370	
0	

Suggestions

Teachers need to exercise caution when planning math lessons for a classroom with students from other cultural environments. Some background on symbols and processes used by other foreign school systems is helpful to the teacher when designing games, activities, and selecting teaching strategies. The classroom activities used should acknowledge the students' past experiences in math and help them make a smooth transition to the different processes, symbols, and vocabulary used in the teaching of math in the United States.

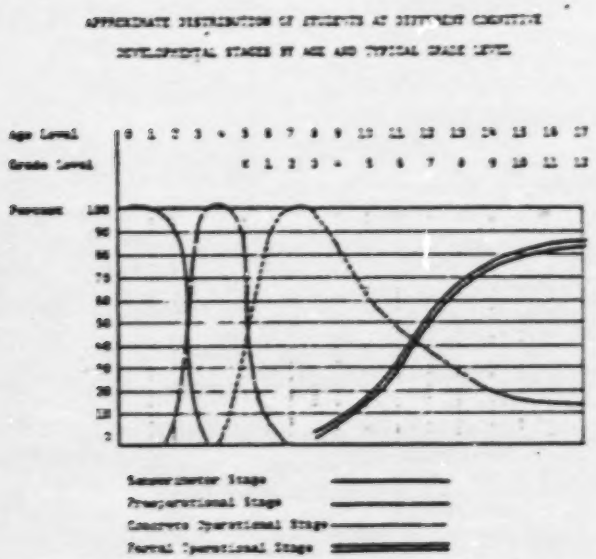
(Minerva Coyne is the Bilingual Consultant-Curriculum Materials Specialist with the Midwest Resource Center. She is a former Jr. High foreign language teacher and was director of the bilingual program in Wheeling, IL)



Manipulatives: The Missing Link

by Nancy Dew

As children mature, according to Piaget, they move through stages of intellectual development. At each stage new intellectual abilities are acquired that enable certain kinds of corresponding activities. The stages are *Pre-operational* (mental operations limited to perception or appearance), *Concrete Operations* (mental operations limited to experience with concrete objects and events), and *Formal Operations* (abstract thinking becomes possible, operations are possible without concrete experience). Each individual goes through the same process, but it is a very personal development. While some children achieve the later stages at an early age, others remain in the early stages for a long time. Some never develop to the later stages due to poor language development or lack of mental ability. [See Hamayan/Dew article in this issue for a discussion of language development as it relates to the ability to use abstract reasoning.] All children have an uneven movement from one stage to another. In any one classroom there will be students at differing stages of mental development. (See Figure I for a representation of the variety in grades K-12). If teachers are to make certain that the methods and materials they use respect all students' developing intellect, then activities must be chosen that correspond to all stages of development present.

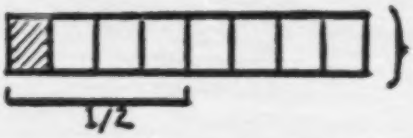


James S. Echenrod, "Thinking About Interdependence, Conflict, Communication and Change", Nov. 1978, Center For Global Perspectives, 218 E. 18th Street, New York, NY 10003, p. 1

Most children, and even adults, prefer an introduction to new ideas and problems through concrete examples and multisensory exploration with manipulatives. All learning (real understanding rather than rote memorization of process) begins with direct experience. It is the direct experience that later becomes the mental image that can be recalled by a picture or sketch of the real object. Finally, symbols can be used as an abstract representation of the concept. Notation is merely the abstract representation of the real experience. For example, students learning division of fractions by whole numbers should procede like this:

concrete - students divide half a stick of gum so that it can be shared equally by four friends.

representational - students make a drawing to record their results (they will always be asked to relate to the whole piece of gum).



Dividing 1/2 into fourths

abstract - then they can learn the abstract notation for the process:

$1/2 \div 4 = (1/2 \times 1/4) = 1/8$

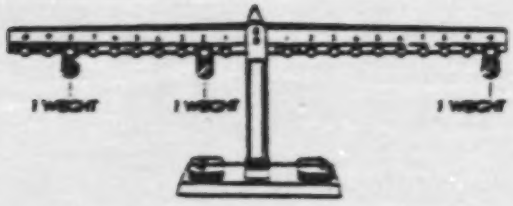
The most important level is the experience with the concrete. Students need a wide range of concrete experiences to produce a good stock of visual images necessary for abstract thought to have meaning. This can only occur if each concept presented begins with the concrete and proceeds to the abstract. Then, regardless of where the student is developmentally, he/she can relate to the activities to the level that he/she is able.

Math series, both monolingual and bilingual, do not reflect very well what we know about how children learn. On occasion there is a picture or sketch which precedes the manipulation of the abstract symbols, but concrete experience so crucial to learning is severely neglected or entirely omitted. The core element of successful mathematical development is left to the teacher's imagination and effort, or lack of the same. His/her crucial contribution is to create an environment in which students can encounter mathematical concepts in a physical, multisensory, real-world context so that all the rest of what they encounter in the math program makes sense. This makes their use of manipulatives in presenting concepts the missing link to meaningful math instruction.

Manipulatives

Using Math Manipulatives

by Nancy Dew



The INVICTA mathematical balance (pictured) is an inexpensive, hands-on approach to problem solving and concept development. It is adaptable to many curriculum levels and any language group and thus is a very useful tool in an individualized bilingual program, or any bilingual program which strives to foster an investigative approach to concept development. In this approach the student observes number relationships, records his/her findings and generalizes about mathematical concepts based on a series of activities. In the traditional math series (bilingual versions included), students are expected to move rapidly from manipulating the concrete to pictorial representations and on to symbolic or abstract presentations of mathematical concepts. In upper level programs the concrete experience is totally lacking—perhaps an illustration (pictorial representation) heads a textbook page but the goal is to complete a series of abstract problems. This format is often received by the student as dull and meaningless and the problems are completed in a rote manner with little or no understanding of the underlying concept.

The independent investigation approach, in addition to being enjoyable and direct, is open-ended, in that the student has the freedom to go from the suggested activity to a level where he/she creates and analyzes problems of his/her own formulation. The INVICTA balance is a self-correcting tool, as any deviation from the correct solutions will surface immediately in a visible inequality or imbalance. The student follows this basic approach: a series of equations involving number relationships are presented. The student checks the accuracy of various solutions using the INVICTA mathematical balance. The correct solutions are recorded. The student talks about what he/she found. It's that simple!

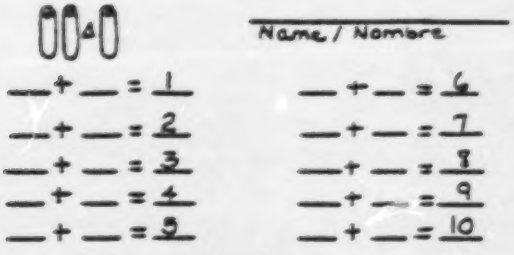
The following are some sample activities at four levels of concept development:

Sample 1: Addition Facts to 10—Discovering Solution Sets (this is the activity pictured on the balance above)

Procedure: Two weights are placed on the left side (but not on the same peg) to balance one weight on the right side. There may be no solution, one solution or many solutions found to each problem:

$x + y = 1$ (no solution)
$x + y = 2$ (no solution)
$x + y = 3$ (2 + 1)
$x + y = 4$ (3 + 1)
$x + y = 5$ (4 + 1, 2 + 3)

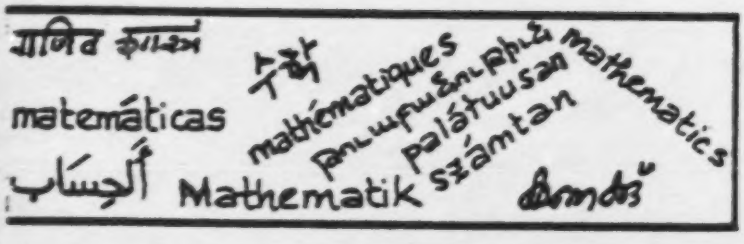
Sample Worksheet:



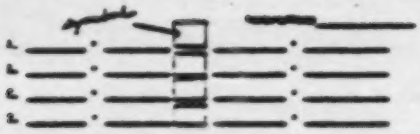
Sample 2: Using Equality/Inequality Symbols (>, <, =)

Procedure: Weights are placed on any two numbers on the left side and any two numbers on the right side. If the arm is lower on the left the student places the symbol > between the two sides of the equation. If the arm is lower on the right the student places the < symbol. If the arm balances the student places the = symbol.

(i.e., 2 + 5 > 3 + 1)



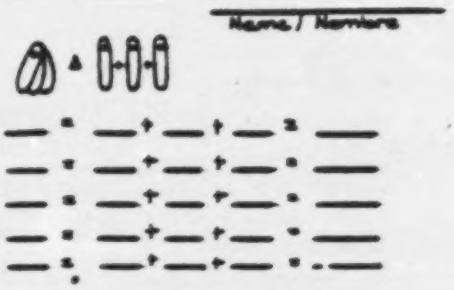
Sample Worksheet:



Sample 3: Multiplication; 3 times tables.

Procedure: Three weights are placed on any peg on the left side. The student then attempts to balance the arm with a weight on each of three different pegs on the right side. (i.e., 3 × 2 (three weights on the #2 peg = 3 + 2 + 1 (one weight on the #3, one on the #2 and one on the #1 pegs, respectively.) The product (3 times some number) = a sum of three numbers.

Sample Worksheet:



Sample 4: Converting Fractions to Percents.

Procedure: Use the reverse side of the balance which has space above the pegs for adhesive labels that can be given any series of values (i.e., fractional, decimal, money, or metric measurement values.) Place the following labels on the balance.

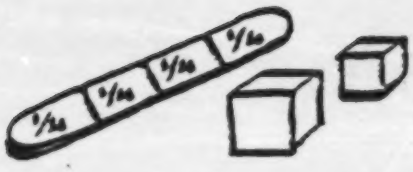
100% 90% 80% 70% 60% 50% 40% 30% 20% 10% (left side)
1/10 2/10 3/10 4/10 5/10 6/10 7/10 8/10 9/10 10/10 (right side)

Problem: Find the series of fractional solutions to these equations:

$x + y = 10\%$ (no solution)
$x + y = 20\%$ (1/10 + 1/10)
$x + y = 30\%$ (1/10 + 2/10)
$x + y = 40\%$ (1/10 + 3/10, 2/10 + 2/10)

These sample activities should give some idea of the versatility of this fine manipulative tool for facilitating concept development and problem solving abilities. If you should want any further information regarding purchase or activities contact:

1) Invicta Plastics, Ltd., Suite 923, The Toy Center, 200 5th Ave., New York, N.Y. 10010 (Publication entitled: "Using the Invicta Mathematical Balance")
2) Creative Teaching Associates, P.O. Box 293, Fresno, CA 93708 (Publication entitled: Explorations with the Mathematics Balance)
3) Nancy Dew, Illinois Resource Center, 500 S. Dwyer, Arlington Heights, IL 60005 (for inservice)



Math Manipulatives: Color Cubes and Fraction Bars

by Dennis Terdy

Learning new concepts in math for limited-English-proficient students is usually complicated by new vocabulary and grammatical structures. Waiting until the student has sufficient English proficiency to teach new concepts obviously delays progress in math instruction for the student. One way of introducing new concepts and ideas in math while minimizing the need for English language proficiency is through the use of manipulatives.

Manipulatives are objects which provide students with concrete experiences in order to learn new concepts. Two types of manipulatives which have many diverse uses in math instruction are color cubes and Fraction Bars.

The color cubes are available from several sources* and come with activity guides showing activities appropriate for kindergarten through senior high school. The cube activities allow for practical experiences in addition, subtraction, multiplication, and division. Other activities include work with fractions, odd and even numbers, different bases, place value, factoring, sets, and the communitative and associative properties of addition and multiplication. Also, there are introductory geometry activities that include work with the Pythagorean Theorem, and with computing area and volume of various figures.

Another manipulative which can be used by limited-English-proficient students is called Fraction Bars. (*Fraction Bars* is a program available through Creative Publications, 3977 East Bayshore Drive, P.O. Box 10328, Palo Alto, CA 94303. Price varies by size of set ordered.) Each color of these durable cardboard bars represent a specific fraction (i.e. red = sixths, blue = fourths, etc.).

The Fraction Bar lessons and activities are organized by seven spiraling topics. These topics include basic concepts: equality, inequality, addition, subtraction, multiplication, and division of fractions.

The three levels of the sets (readiness, introductory, and applied) also include worksheets, tests, and games. Although the Fraction Bars are recommended for grades 3 through 8, they seem quite appropriate for higher level students with general math needs.

Many times success in math for limited-English-proficient students greatly decends on their language ability. Color cubes and Fraction Bars minimize the need for English-language-proficiency and allow the student to experience early success in math instruction.

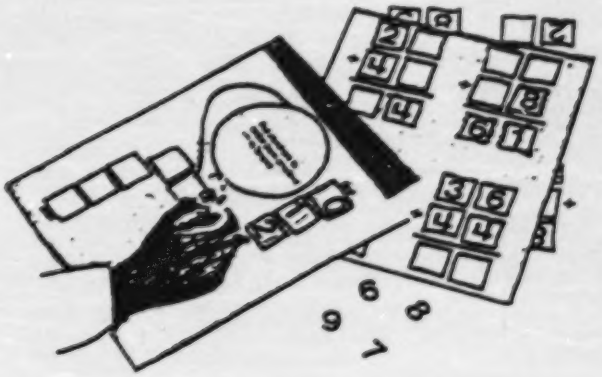
*(check math catalogs to find them.)

CULTURALLY RELEVANT/CONTROLLED ENGLISH MATERIALS

TEXTBOOKS	TITLE	SAMPLE PAGE(S)
Creative Publications 3977 E. Bayshore Road P.C Box 10328 Palo Alto, CA 94303 (415) 968-3977	Try-A-Tile-Cards Classroom Activity Cards Set B Grades 2-6 ⊕ ⊖ Set C Grades 4-8 ⊗ ⊕	

Notes:

Tactile learning approach



Motivational device: secret message

Adventures With Arithmetic
Fractions, Decimals, Percent, Algebra

LA CHINA POBLANA

Several centuries ago, a beautiful but lonely Chinese princess named Mai Ling lived in Peking, the Forbidden City. One day, the princess escaped from the palace and went to the beach. It was a long walk and the princess became so tired she fell asleep in the center of an empty boat. When she awoke, she found herself on a pirate ship headed for Mexico where she was to be sold as a slave.

Fortunately, a wealthy merchant from Puebla bought Mai Ling and raised her as one of his own children. She was recognized for the beautiful embroidery on her shirts. Her brightly coloured oriental store designs of birds, flowers, dragons, and butterflies were so popular, Puebla women began to copy her work on their home dresses.

To learn how the Chinese princess is honored in Mexico, solve the problems below.

FIRST, work the problems and locate each answer in the table.
SECOND, place the letter by the answer in the blank next to the problem.
THIRD, match the numbers by the pirates with the corresponding letters.

1. ___ −8 + (7)
2. ___ −3 + (−7)
3. ___ +3 + (−7)
4. ___ −3 + (7)
5. ___ −3 + (3)
6. ___ 7 + _____ = 16
7. ___ + ½ + (−½)
8. ___ −½ + (−½)
9. ___ 1½ + (−½) + (−½)
10. ___ _____ + (−3) = −6
11. ___ −3 + (−4.2) + (−3.1)
12. ___ −6 + _____ = 1
13. ___ _____ + 8 = −1
14. ___ 7 + (−8)
15. ___ 8 + _____ = −8
16. ___ −¾ + (−2) + (−2¾)
17. ___ −6 + _____ = −13
18. ___ 8 + _____ = 0
19. ___ 14.1 + (−15.7) = −1.6

A = 2	E = −4	L = 3	P = 16	U = 0
B = 7	F = −1	M = −3	R = −6	X = −6
C = 1	H = 8	N = 4	S = −16	Y = −8
D = −7	I = 5	O = −2	T = −10	

6

2 −14 −17 −7 −10, 2 −15 −3 6 −7 −2 −8 −16 −6 −7 −8
8 −14 −15 −2 −5 −16 −2 16 −13 16 −3 −11 −6 −9 −14 5 −15
5 −7 −8 −6 −3 −17 6 −7 5 −15 −6 −6 −7 1 −14 −13 −6 −7 −6 −7
7 −13 −2 −3 −10 3 −15 −2 1 −15 −6 −6 −6 −3 −15 −15

7

SOURCE	TITLE	SAMPLE PAGE(S)
Creative Publications (continued) Repetition with variation: short term memory aid	Tangle Table ⊕ ⊗ facts	

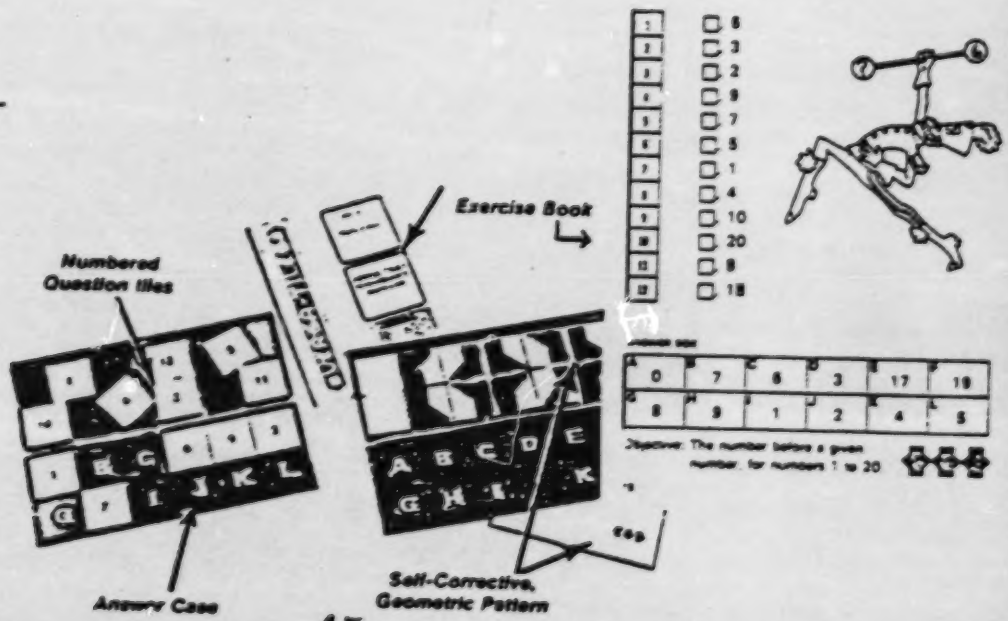
Educational Teaching Aids (ETA) 159 W. Kinzie Street Chicago, IL 60610	Versa-Tiles Math Sets: Math Lab Sets Competency Kits: (Remediation Program)	(Primary 2-4) (Int. 4-6) (Int. 4-6) (7-12)

Notes:

Tactile,

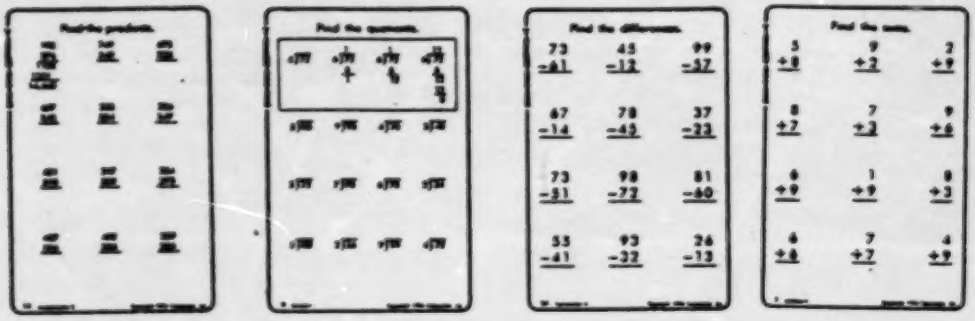
Self-correcting,

Discovery motivational device.



SOURCE	TITLE	SAMPLE PAGE(S)
Instructional Fair, Inc. P.O. Box 1650 Grand Rapids, MI 49501	Taskmaster Math Skills Duplicating Books or Wipe Clean Cards	(Grades 3-8)

Reusable

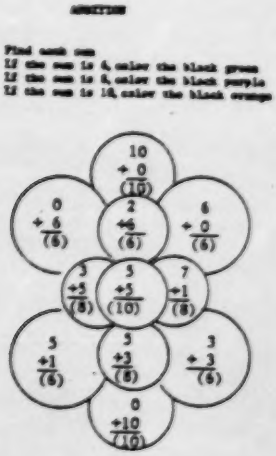


Mathart (Grades 1-6)

Varies drill format,

Coloring is calming activity for hyperactive,

Allows for some artistic input.



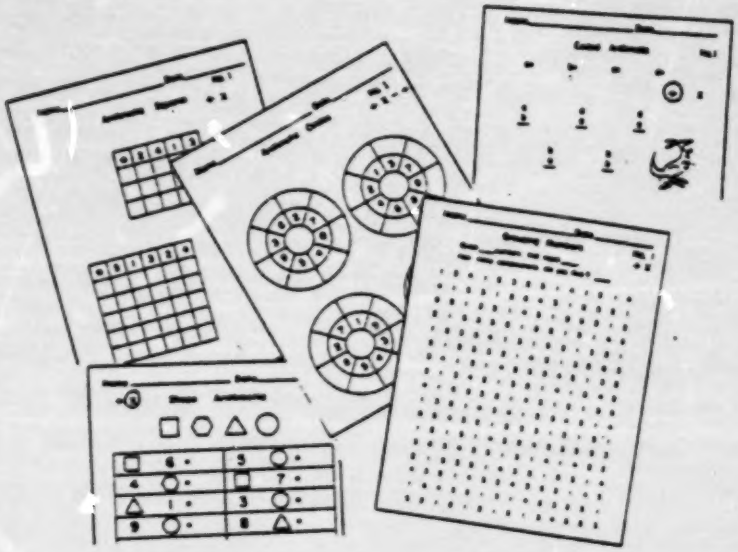
SOURCE	TITLE	SAMPLE PAGE(S)
Love Publishing Co. 1777 S. Bellaire Street Denver, Colorado 80222	Individualized Arithmetic Instruction	(adjustable for all levels)

Notes:

Meets the needs of a multi-level group,

Varies drill format,

Very creative formats.



Prentice-Hall Learning Systems, Inc.
Dept. C1, Box 47X
Englewood Cliffs, NJ 95106

or

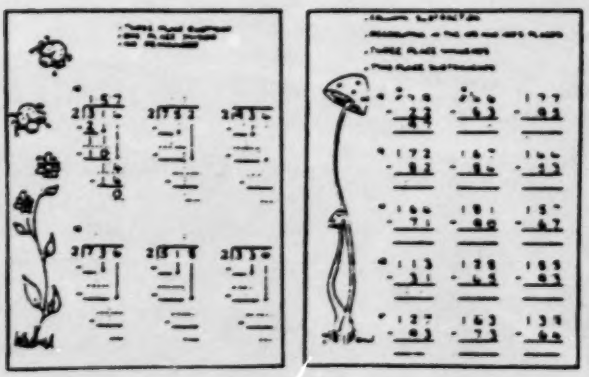
P.O. Box 527
San Jose, CA 95106

Slam/Addition
/Subtraction
/Multiplication
/Division

(Grades 3-6)

Practice with American paradigms,

Helps students with poor motor coordination keep problems in line.

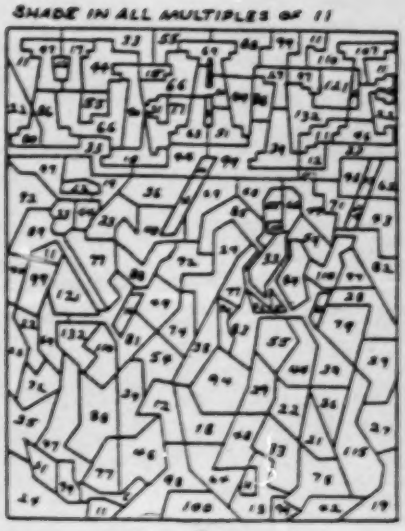


SOURCE	TITLE	SAMPLE PAGE(S)
Prentice-Hall Learning Systems, Inc. (Continued)	Contemporary Math Shade Ins Contemporary Metric Shade Ins	(Grades 4-6)

Culturally based,

Motivational device-secret message,

Calming coloring activity.

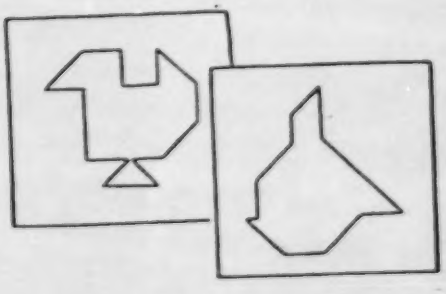


Prentice-Hall Learning Systems, Inc.

Tangram Tasks

Practice for those with visual perception difficulties,

Problem Solving Practice.

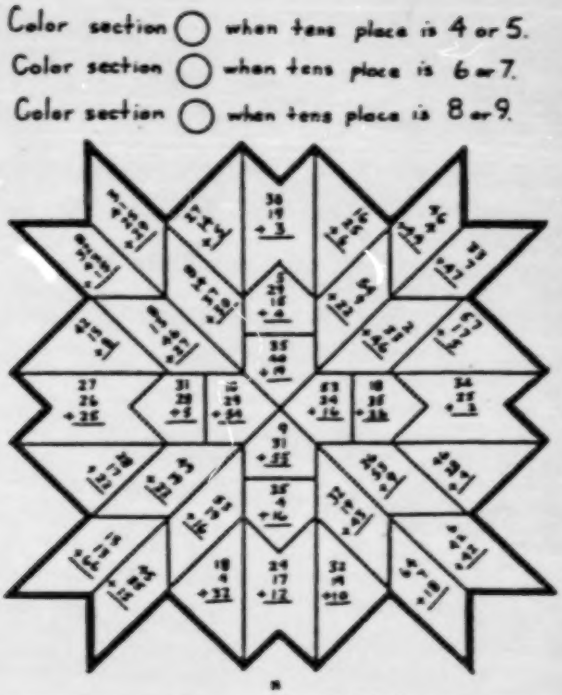


SOURCE	TITLE	SAMPLE PAGE(S)
L & M Educational Enterprises P.O. Box 88 Santa María, CA 93454 or The Teachers Market Place P.O. Box 17907 Los Angeles, CA 90017	Aztec Math Primary Books 1,2 Intermediate Book	(Grades 1-6)

Notes:

Reinforces concepts while practicing computation

Allows for artistic input


COLUMN ADDITION - REGROUPING
Color section ◯ when tens place is 4 or 5.
Color section ◯ when tens place is 6 or 7.
Color section ◯ when tens place is 8 or 9.

COMMERCIAL MATH LAB PACKAGE PROGRAM

Prescription Learning Corporation
P.O. Box 2377
Springfield, IL 62705

Contact Person:

Carolyn Spears

Prescription Learning Corporation sells 12, 18 or 24 station math labs, diagnostic and prescriptive services, materials, equipme and computerized student assignment sheets. They will upon request modify their package to include materials in languages other than English. Included in their Math Lab package are many hands-on type of materials appropri ate for LEP stu ents.

SPANISH/ENGLISH MATERIALS

TEXTBOOKS

SOURCE	TITLE	GRADE LEVELS
Addison-Wesley Publishing Co., Inc. School Division National Headquarters 2725 Sand Hill Road Menlo Park, CA 94025	New Series: Las Matemáticas En Nuestro Mundo (Spanish adaptation of: Math In Our World (1979)	(1-2 available - plan 1-6)
	Old Series: Matemática Para La Educacion Primaria (Spanish adaptation of Elementary School Mathematics (1968)	(K-6)
Allyn and Bacon, Inc. 470 Atlantic Avenue Boston, MA 02210 or Western Region Ralston Park Belmont, CA 94002	Repaso Matemático/ Refresher Mathematics (1971) Bilingual, Spanish/English	(5-9)
Curriculum Development Associates, Inc. 1211 Connecticut Ave., N.W. Suite 414 Washington, DC 20136 or 266 Grand Avenue-Suite 280 Oakland, CA 94610 or Creative Publications P.O. Box 10328 Palo Alto, CA 94303	CDA Mathematics Program (1974) Banking on Problem Solving; Drill and Practice At the Problem Solving Level (all materials are bilingual Spanish/English)	(1-9) (2-6) (K-6)

TEXTBOOKS (CONTINUED)

SOURCE	TITLE	GRADE LEVELS
Dissemination and Assessment Center for Bilingual Education (DACBE) Lesley College 7703 North Lamar Blvd. Austin, TX 78752	Las Matemáticas: Lenguaje Universal (Aguila Volante Series, 1978) (Paperbound textbooks & teacher's guides)	(Interm. 4-6, Sec. 7-12)
Houghton Mifflin Co. 777 California Ave. Palo Alto, CA 94304	Matemáticas Para Logro Individual -- Libro de Trabajo (Translation of some of the pages of the Mathematics For Individual Achievement Series (1975) workbooks. Available free to any district with the MIA Series.)	(1-8)
Scott Foresman & Co. 1900 E. Lake Avenue Glenview, IL 60025	Matemáticas, Conceptos y Practica (Adaptation of Scott Foresman Mathematics Program) (1980)	(K-3 avail., plan K-6)
Silver Burdett Co. 250 James Street Morristown, NJ 07960 or Western Regional Office 2450 Embarcadero Way Palo Alto, CA 94303	Matemática de Silver Burdett (Adaptation of 1973 edition of Silver Burdett Mathematics Program)	(1-8)

INDIVIDUALIZED SYSTEMS/CURRICULUM GUIDES/COMPUTERIZED INSTRUCTION:

SOURCE	TITLE	GRADE LEVELS
AARC Educational Sales Co. P.O. Box 14525 Long Beach, CA 90803	MAS Mathematics Pre/Post Tests, Prescriptions Record Keeping (profiles) Evaluation System Levels A-F Bilingual English/Spanish	(1-6)
Educational Developmental Laboratories McGraw Hill Book Company Dept. E 1221 Avenue of the Americas New York, NY 10020	EDL Compu Cards: Placement Tests, Evaluation Cards, Teacher's Guide, Progress Sheets, Multilingual Materials English/French/Spanish	(1-6) (Remedial 7-12)
Los Angeles Mathematics Program (LAMP) Los Angeles Unified School District 450 N. Grand Avenue Room A-319 Los Angeles, CA 90012 Attention: Robert Ramada, Mathematics Specialist	LAMP Complete Individualized Classroom Mathematics Management System Bilingual: English/Spanish Cross referenced to: Addison Wessley CDA Holt Houghton Mifflin Scott Foresman and Silver Burdett	(k-8)
P.R.A.I.S.E. Math Program 17855 Sand Canyon Road Canyon County, CA 91351 Attention: Jerry Burrill	P.R.A.I.S.E. Program Comprehensive competence based mathematics program workbooks, test kit, cassette tapes Spanish/English	(6-12)
Board of Education City of Chicago Dept. of Curriculum 228 N. LaSalle Street Room 838 Chicago, IL 60601	Math Curriculum Guide for Spanish-Speaking Students Level A-D (1975) Level E-F (1978)	Teacher's Reference

SOURCE	TITLE	GRADE LEVELS
Computer Curriculum Corporation P.O. Box 10080 Palo Alto, CA 94303	Mathematics Strand 10 minute daily lesson-Problems generated to student at terminal; Available in Spanish or English	(1-6)

KITS/CASSETTE TAPE PROGRAMS/RECORDS

SOURCE	TITLE	GRADE LEVELS
Addison-Wesley Publishing Company, Inc. 2725 Sand Hill Road Menlo Park, CA 94025	Buscadores de Habilidades/ Skillseekers ⊕ ⊖ Kit ⊗ ÷ Kit plan to develop fractions and decimals kit English or Spanish cassette tape program	(2-6)
Bowmar/Noble Publishers, Inc. 4563 Colorado Blvd. Los Angeles, CA 90039	Math Zingo Bingo game drill kit with record + - x ÷	(2-6)
Charles E. Merrill Publishing Co. 1300 Alum Creek Drive Columbus, OH 43216 or Robert L. Dees, Manager Western Region 504 S. Arden Street Anaheim, CA 92802	Las Skilltapes de Matematicas de Merrill + - x ÷ Fractions (Spanish adaptation of Merrill Mathematics Skilltapes --- Introduccion a la Geometría (Spanish adaptation of Introduction to Geometry)	(3-9) (6-9)

SOURCE	TITLE	GRADE LEVELS
Kimbo Educational P.O. Box 477 Long Branch, NJ 07740	Basic Math Discos en Español Math tables for #'s 1-10 ⊕ ⊖ Record ⊗ ⊕ Record	(1-4)
Science Research Associates (SRA) 259 E. Erie Street Chicago, IL 60611	Conjunto de Historias Matematics + - x ÷ Cassette Tape Program	(2-6)

WORKBOOKS/WORKSHEETS/DUPLICATING BOOKS:

SOURCE	TITLE	GRADE LEVELS
Educational Consultants, Inc. P.O. Box 66, Dept. M-2 Euless, TX 76039	Finger Calculating/ Calculando con Los Dedos (Worktexts) Available in Spanish or English Elementary and Intermediate worktext with Teacher's Guides	(1-6)
Key Curriculum Project Box 2304 Station A Berkeley, CA	Clave Para el Algebra/ Key To Algebra 4 booklets in English or Spanish	Independent Pre-Algebra Course

SOURCE	TITLE	GRADE LEVELS
Linguametrics Group P.O. Box 454 Corte Madera, CA 94925	Finding Out/Descubrimiento 170 Science/Math Activities on Task Cards Student workbook, Teacher's Guide in Spanish or English	(1-6)
Los Angeles Unified School District Instructional Publications Unit G-230 450 North Grand Avenue Los Angeles, CA 90012	Actividades Con Bloques Modelo/Activities With Pattern Blocks Actividades Tangram/ Tangram Activities Spanish or English Editions	(K-6)
Merrill Publishing Co. 1300 Alum Creek Drive Columbus, OH 43216	Topicos de Matemáticas/ Nongraded Mathematics Topic - Texts Duplicating books Drill and Practice ⊕ ⊖ ⊗ ⊘ Fractions and Decimals Available in Spanish or English	(3-9)
National Textbook Co. 8259 Niles Center Road Skokie, IL 60077	Divercicios Matemáticos/ Drillsville Duplicating Masters Spanish or English --- Math Purpose Puzzles Cross-Number Puzzles Duplicating Masters English, French or Spanish	(1-8) (1-8)

SOURCE	TITLE	GRADE LEVELS
Pan American Book Co. 4362 Melrose Avenue Los Angeles, CA 90029 or Ray Action Co. Bilingual/Multicultural Material Development 10546 Burbank Blvd. Suite 4 N. Hollywood, CA 91601	Math-Art For the Classroom 6 Books of Shade-In Puzzles in Spanish & English Multicultural Math Shade Ins 3 Books of Shade-In Puzzles in Spanish and English Cover operations with whole numbers, fractions, decimals, percent, number theory, measurement, exponents and integers	(3-9)
Prentice-Hall Learning Systems, Inc. Dept. C1, Box 47X Englewood Cliffs, NJ 07632	North American Soccer League Shade-Ins National Hockey League Shade-Ins ⊕ ⊖ ⊗ ⊘ , fractions decimals, percents, roman numerals Bilingual: Spanish/English	(4-8)
Illinois State Board of Education Program Planning and Dev. 100 North 1st. Street-42 Springfield, IL 62777	Matematicas de Carretera (Edición metrica en Español de Road Map Math) (1979)	(6-10)

CHINESE/ENGLISH MATERIALS
JAPANESE/ENGLISH MATERIALS
KOREAN/ENGLISH MATERIALS
PILIPINO/ENGLISH MATERIALS

TEXTBOOKS/WORKTEXTS/CURRICULUM GUIDES:

SOURCE	TITLE	GRADE LEVELS
Asian American Bilingual Center 2168 Shattuck Avenue Berkeley, CA 94704	Mathematics: Identity, Needs and Interaction (Pilot Test Edition) Chinese Pilipino	Introductory Level and Level One (Elementary)
BABEL (Bay Area Bilingual Education League) 2168 Shattuck Avenue Berkeley, CA 94704	Math I, II Chinese	(6-8)
Board of Education City of Chicago Dept. of Curriculum 228 N. LaSalle Street Room 828 Chicago, IL 60601	Mathematics Curriculum Guide for Chinese-Speaking Students (1975)	Teacher Reference
National Assessment and Dissemination Center for Bilingual Education (NADC) Lesley College 49 Washington Avenue Cambridge, MA 02140 or Asian Bilingual Curriculum Development Center Seton Hall University South Orange, NJ 07079	Math Text Four Part Text and Tests (Pilot Test Edition (Vol. I and II) Chinese Korean Japanese	(7-8)

SOURCE	TITLE	GRADE LEVELS
Oakland Board of Education Curriculum Office 1025 Second Avenue Oakland, CA (415) 836-8100	Metric System (English/Chinese) Pre-Algebra Book I,II (English/Chinese)	(7-9)
Phillipine and Asian Book Center 611 Geary Street San Francisco, CA 94102	Modern Math-Bagong Matematica (English/Pilipino)	(K, 1-6)
San Francisco Unified School District Curriculum Office, Room 124 135 Van Ness Avenue San Francisco, CA 94102	School Mathematics I, II (Chinese) Geometry (Chinese) Algebra - Its' Elements and Structure (Chinese) (1974)	(7-10)

VIETNAMESE/ENGLISH MATERIALS
LAO/ENGLISH MATERIALS
THAI/ENGLISH MATERIALS

TEXTBOOKS/SUPPLEMENTS/AUDIO PROGRAMS:

SOURCE	TITLE	GRADE LEVELS
BABEL (Bay Area Bilingual Education League) Indochinese Center 2168 Shattuck Avenue Berkeley, CA 94704	English-Vietnamese Terminology for High School and Junior College Students	(9-12)
	Book I: Mathematics (Quyen I: Toan-Hoc)	(8-10)
Bilingual Education Service Center c/o Erna Fack 500 S. Dwyer Avenue Arlington Heights, IL 60005	Mathematics: A Vietnamese Supplement (1977) Covers terminology and concepts of Geometry	(9-12)
Center for Applied Linguistics 3520 Prospect St., N.W. Washington, D.C. 20007 (202) 298-2929 Toll Free (800) 424-3700	Em Hoc Toan/I Study Arithmetic Lop Nam (Grade 1) Lop Tu (Grade 2) Lop Ba (Grade 3) Vietnamese	(4-9)
Center for Educational Experimentation 218 Lindquist Center University of Iowa Iowa City, IA 52242 Contact Also: Dr. Alan Henkin (319) 353-5400 For computer Curriculum Offerings for Apple II System This Center is constantly producing new classroom materials. Get on their mailing list to stay current.	Fun With Arithmetic (Audio Cassette, Printed Test) Cambodian Lao Spanish Vietnamese	(Elementary) Three levels available: Basic (2,3,4), Interm. (4,5), Advanced (6,7,8)
	Fun With Fractions (Printed books computer assisted instruction) Cambodian Lao Spanish Vietnamese	(3,4,5) Two levels available: Basic and Intermediate

OTHER LANGUAGES

SOURCE	TITLE	GRADE LEVELS
Board of Education City of Chicago Department of Curriculum 228 North LaSalle Street Room 838 Chicago, IL 60601	Mathematics Curriculum Guide for Arabic-Speaking Students (1978)	Teacher Reference
	Mathematics Curriculum Guide for Greek-Speaking Students (1975)	Teacher Reference
	Criterion-Referenced Tests in Mathematics (Greek)	Teacher Reference
	Mathematics Curriculum Guide for Italian-Speaking Students (1975)	Teacher Reference
	Mathematics Curriculum Guide for Polish Speaking Students (1977)	Teacher Reference
National Assessment and Dissemination Center for Bilingual Education (NADC) Lesley College 49 Washington Avenue Cambridge, MA 02140	Matemática Book I & II (Portuguese) Textbook, Workbook and Teacher's Guide	Early Elem.
Arabic Language Bilingual Materials Dev. Center 611 Church Street Ann Arbor, MI 48104	In the process of translating and editing basic math materials	(1-3)
Dissemination and Assessment Center for Bilingual Education 7703 North Lamar Austin, TX 78752	Ha' at' iish At'e (A math workbook) Navajo	(Pre-School) Basic math Terms introduced

SECTION III; MANAGEMENT AND RECORD KEEPING

Math Lab Management Tips

1. Provide a check out system for materials and equipment used in the lab or at home. A file card box is recommended.

2. A filing system is also recommended for unit quizzes and answer keys. Store masters in a locked file cabinet to prevent loss of originals.

3. Find and train peer or cross-age tutors and assistants. This reduces your dependency on adult staff for efficient program operation.

4. Devise a method to track each student's progress. A student profile sheet kept in a file folder is recommended.

5. Train all students to function as independently as possible. A lab is an excellent place to teach respect for others and cooperation. Typically a thorough training period takes from two weeks to one month. It is time well spent.

6. Place materials that receive frequent use in plastic sleeves or have them laminated. Tests and worksheets in particular can retain their usefulness much longer with this treatment.

7. Use a Learning Assistance Package (LAP) Teacher Reference Sheet to compile all available materials to teach a particular skill or concept. (See sample next page.) Assign students work on an assignment card or sheet following same format.

8. Classroom management boards and charts are helpful to assign and/or distribute work. (See samples on second page of this section)

LEARNING ASSISTANCE PACKAGE

TEACHER REFERENCE SHEET

Skill Objective: Using these materials the child will demonstrate his ability to _____

_____

as measured by his performance on the Criterion Referenced Test.

I. Student Activities included in this LAP

A. Games and Puzzles-

Games	Puzzles

B. Drill Sheets-

C. Other Activities

1. Worksheets to accompany manipulatives, listening center, math lab, etc.-

2. Task Cards-

D. Criterion Referenced Test-

LEARNING ASSISTANCE PACKAGE TEACHER REFERENCE SHEET (Cont'd)

II. Teacher Reference for this LAP

A. Teaching Ideas and Strategies-

B. Textbook Pages-

name of book or series	Bk.#	Bk.#	Bk.#

C. Drill Sheets-

name of book or series	Bk.#	Bk.#	Bk.#
other:			

D. Manipulatives and Aids that can be used by the teacher or student.

E. Kits-

F. Commercial Games and Activities-

G. Commercial Task Cards-

H. Tapes-

I. Filmstrips-

J. Films-

K. Teacher Resource Books-

Skill: _____

Teacher's Guide
for
RES03 CLASSROOM MANAGEMENT BOARD
(Large Pockets)

ROBERT E. SHORE AND ASSOCIATES, P.O. BOX 296, Kentfield, California 94914

RES03 Classroom Management Board is a large pockets board. Six 9"x10" white pockets lock on a 20"x48" mocha backboard. Four 4"x4" white pockets complete the board.

Large pockets are ideal for standard 8 1/2" x 11" papers. A v-cut front on the large pockets permits easy placement of numerous other paper (and card) sizes commonly found in most classrooms. Each pocket holds up to 100 sheets of paper.

How to use the Large Pockets Board

Homework Center

Each pocket on the large pockets board can be reserved for homework for a specific subject. Pockets can be labeled SPELLING, MATH, VOCABULARY, etc. Finished homework is deposited in the appropriate pocket. Pockets can be designated for work for specific groups or levels.

Distribution Center

The board can be used as a distribution or flow center for homework papers and notices to go home. During class time various worksheets can be kept in the large pockets for ready distribution to groups and individuals.

Record Keeping Board

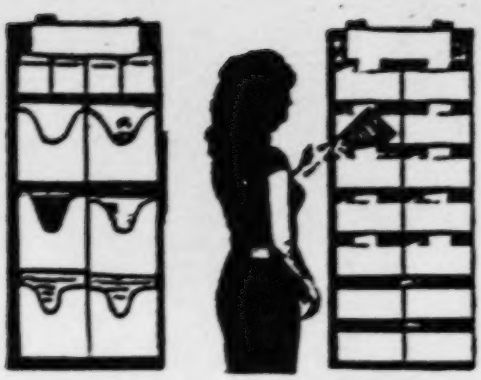
Student profiles and other record forms which are used weekly can be kept in the large pockets ready for instant retreval by teacher and students. Pockets can be labeled A-D, E-H, etc., for students whose names fall within these letters of the alphabet.

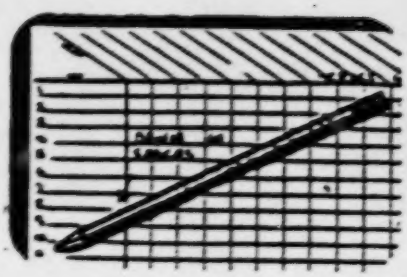
Math Resource Center

Worksheets for ADDITION, SUBTRACTION, MULTIPLICATION, and DIVISION can be kept in four of the large pockets. Extra credit work can be kept in the two remaining large pockets. Answer keys can be kept in the four small pockets.

Cross number puzzles, word problems for various levels, brain teasers, and other math enrichment activities can be kept in the large pockets.

MIDWEST VISUAL EQUIPMENT COMPANY
6500 N. Hamlin Avenue
Chicago, Ill. 60645





Classroom Organization Boards

To organize and display classroom resources. 20"x48" corrugated board units provide pockets to hold a variety of task cards, activity sheets, booklets, etc. Units are shipped flat with assembly instructions.

BT3 - Classroom Management Board

With 6 spacious 9"x10" pockets, plus 4 small 4"x4" pockets & guide. $8.50

BT6 - Classroom Resource Board

14 handy 4"x9" pockets, each with room for over 100 cards. With guide $8.50

BT50 - Self-Adhesive Window Envelopes

Set of 50 clear 4"x4" envelopes for labeling pockets of the BT3 or BT6 Boards. $2.50

LK1302 - Write & Wipe Project Grid

Giant 15"x21" write-on, wipe-off grid with ample room for 40 names and 40 different projects. Ideal for recording individual assignments and progress. Long-lasting marker included. $2.50

SECTION IV: FURTHER RESOURCES FOR BILINGUAL MATH LABS

OTHER USEFUL EQUIPMENT FOR A BILINGUAL MATH LAB

Language Master, Caliphone or Cassette Recorder (Contact local audio-visual distributors)

-- to drill math facts and vocabulary

Electronic Teaching Aids

The Little Professor, Dataman, Speak & Math, Math Marvel, Sharp Calculators, Calculator for the Overhead Projector (Creative Publications); Invicta Electronic Master Mind, Charlie the Teaching Robot, Quiz Kid, Electronic Cash Register with Calculator (Educational Teaching Aids)

Texas Instrument's Little Professor and Math Marvel Electronic Educational Games are available in Spanish and English from:

SOPRIS West, Inc.
1120 Delaware Avenue
Longmont, CO 80501

-- to drill facts and correct own work.

Metric Teaching Aids: Linear, Area, Mass, Volume, Capacity Temperature. Enrich, Inc., 760 Kifer Road, Sunnyvale, CA 94086.

-- for individual and group projects and activities.

RESOURCES FOR DEVELOPING YOUR OWN MATERIALS

Multicultural Art Projects, Vera Jo Griswold and Judith Starke, Love Publishing Co., 1777 S. Bellaire, Denver, CO 80222.

Supplies

Markers, stamp pad, taskcard boxes, math lab boxes, numerical stickers, activity card protectors, blank playing cards, dice, game pawns, spinners, chips, blank activity cards, blank game boards. (Creative Publications, local teachers' supply stores.)

Math Activity Worksheet Masters by Mary Laycock and William T. Stokes. Graphic aids for grades 3-12. Through Creative Publications.

Spirit Master Motivators: Clever Characters I, II and Math Characters. Artwork for teacher-made worksheets. Trend Enterprises, Inc., P. O. Box 43073, St. Paul, MN 55164. Also publish wipe-off blank activity cards and Money and Time Telling Card Sets.

TEACHER REFERENCES

Curriculum Guide: Bilingual/ESL Middle School, San Francisco Unified School District, Curriculum Office, Room 124, 135 Van Ness Avenue, San Francisco, CA 94102. Lists course outlines and materials for Bilingual Math, Grades 6-8 (Chinese, Spanish, Pilipino, Japanese, Korean, Vietnamese).

Dissemination and Assessment Centers (for Project-Developed Bilingual Materials)

National Assessment and Dissemination Center
49 Washington Avenue
Cambridge, MA 02140
Greek, Italian, Chinese, Korean, Japanese, Spanish, French, Portuguese

Evaluation Dissemination and Assessment Center for Bilingual Education
Education Service Center, Region XIII
7703 N. Lamar Blvd.
Austin, TX 78752
Spanish, Native American Languages

Stay in touch periodically; new materials are always being developed.

Individualizing Mathematics Instruction, Los Angeles City Schools, District Publications, Room G-230, 450 N. Grand Avenue, Los Angeles, CA 90012, 1975.

See also their publication entitled: Developing Mathematics Interest Centers, 1974.

Other materials available address metric activities and the use of Cuisinaire rods, attribute blocks, geoboards and calculators. Write for a catalog for a complete description.

Mathematics Resource Project, developed at the University of Oregon for use in grades 5-9. There are five resource guides. Each includes worksheets, calculator activities, games, puzzles, bulletin board suggestions, project ideas and more. Through Creative Publications. See also other Math Lab Materials same source for possible application.

Resources for Teaching Mathematics in Bilingual Classrooms, edited by C. James Lovett and Ted Snyder, ERIC® Clearinghouse for Science, Mathematics and Environmental Education. The Ohio State University, College of Education, 1200 Chambers Road, Third Floor, Columbus, OH 43212, January, 1979.